

decomposition product selected from the group consisting of tin oxide and volatile products upon being exposed to reflow conditions; and
storing said protected surface for later reflow.

REMARKS

Status of Claims:

Claims 1-11, 23-25, 27-28, and 33 are pending in the application. Each of the pending claims defines an invention that is novel and unobvious over the cited art. Favorable consideration of this case is respectfully requested.

Summary of the Present Invention:

The present invention relates to a method of protecting solderable surfaces and further relates to a method of soldering surfaces so protected. The present invention selectively precoats the solder surfaces of either a chip, a laminate, or both with a metal-complexing agent in a flux that reacts with the in oxide solderable surface in order to control the reactivity of the surface. The complexing agent is applied from a gas-phase. The complexing agent forms a continuous, thin, metal carboxylate film on the solderable surfaces thus protecting the surfaces from further oxidation. Thus protected, chips and laminates may be stored or handled without concern for oxide thickness growth provided the surfaces remain free of mechanical damage. The carboxylate film of the present invention further provides for solder reflow. Moreover, when exposed to reflow conditions the inventive tin carboxylates decompose to volatile products, leaving a clean, residue-free surface, easily wetted by the solder.

Rejection Under 35 U.S.C. § 103(a):

Claims 1-8, 10-11, 24-25, and 27-28 were rejected under 35 U.S.C. § 103(a) as being anticipated by Pendse (6,059,894) in view of Marshall, Jr (4,491,084).

To establish *prima facie* obviousness of a claimed invention, all the claim limitations must be taught or suggested by the prior art. *In re Royka*. All words in a claim must be considered in judging the patentability of that claim against the prior art. *In*

re Wilson. (MPEP § 2143.03). When evaluating the scope of a claim, every limitation in the claim must be considered. See e.g. *In re Ochiai*. (MPEP § 2144.08). The evidentiary record fails to teach each limitation of the present invention.

The evidentiary record fails to teach each limitation of the present invention. In particular, Pendse fails to teach volatilization of the metal carboxylates under reflow conditions.

Pendse relates to a “fluxing composition...that forms a combination of carboxylate salts and unreacted acid anhydrides when applied to a solder alloy and exposed to temperatures in the range of 150 to 350°C in an inert atmosphere.” (Col 3, lines 23-28). It is known in the art that 150 to 350° C in a hydrogen or other inert atmosphere comprises “reflow” conditions (See Pendse at Col 2, lines 29-34). Moreover Pendse relates to “an integrated circuit assembly comprising an integrated circuit comprising a chip attached to a substrate by a plurality of solder joints and a thin layer of a residue that is reactive with an epoxy used in bonding the chip to the substrate.” (Col 3, lines 46-50, emphasis mine). Pendse specifically does not teach volatilization of tin carboxylates under reflow conditions as does the present invention. Rather, Pendse teaches the carboxylates remain in the joint as a thin film.

The Examiner asserts that Pendse teaches “forming a reaction product with the tin oxide and the complexing agent, wherein the reaction product decomposes to tin oxide and volatile products upon being exposed to reflow conditions (column 3, Lines 50-60).” (Office Action, page 3, lines 2-4). Pendse does not teach volatile reaction products. Pendse teaches non-volatile residues that must remain on the treated surface: “one aspect of the present invention is a fluxing composition comprising a high molecular weight carboxylic acid. The carboxylic acid is chosen on the basis of its ability to form a residue that comprises a combination of carboxylate salts and unreacted acid anhydrides when applied to a solder alloy and exposed to temperatures in the range of about 15 to 350° C in an inert atmosphere.” (Col. 4, lines 20-26). Pendse reinforces this teaching: “the carboxylic acid is chosen on the basis of its ability to form a combination of carboxylate salts and unreacted acid anhydrides when applied to a solder alloy and exposed to temperatures in the range of about 150 to 350° C.” (Col. 5, lines 7-10). Claim 1, as amended, recites “wherein said reaction product decomposes to a decomposition product

selected from the group consisting of tin oxide and volatile products upon being exposed to [reflux] reflow conditions." ("Reflux" is a typographical error. Claim 1 as originally filed recited "reflow"). Pendse specifically teaches away from the present invention. A "residue," comprising an acid anhydride is a required aspect of the Pendse invention and specifically teaches away from the volatile decomposition products of the present invention. Pendse teaches: "[a] thin film of a flux residue is prepared on at least a portion of one or both surfaces to be bonded. The residue is reactive with an epoxy used to bond the surfaces wherein the epoxy lies between the two surfaces. The epoxy is usually an anhydride-curing epoxy, which means that one of the reactions during the curing of the epoxy is the cleaving of an oxirane ring structure by virtue of the acid radical (COOH) from the anhydride group." (Col. 7. lines 16-22). Pendse teaches a required chemically-reactive residue. Therefore Pendse specifically teaches away from volatile products. Teaching away from the invention is a *per se* demonstration of nonobviousness. U.S. v. Adams, 338 U.S.39, 148 U.S.P.Q. 479 (1966). Marshall, Jr. is cited for the desirability of storing the protected surface for later reflow. Marshall, Jr.'s teaching does not relate to the absence of a residue, as required by the present invention, and therefore, does not address the shortcomings of Pendse.

Claim 23 was rejected over Pendse and Marshall, Jr., as discussed above, and further in view of Gao (5,514,414). Gao is cited as teaching vapor phase deposition. Gao notwithstanding, the flux composition of Pendse forms an epoxy-reactive, acid anhydride residue. Therefore Gao does not complete the required teaching because Gao does not relate to volatile decomposition products.

Rejection Under 35 U.S.C. § 103(a):

Claims 1 and 9 were rejected under 35 U.S.C. § 103(a) as being anticipated by Arldt (5,531,838) in view of Marshall, Jr (4,491,084). Arldt discloses and claims a flux composition useful in a soldering process. Arldt does not disclose providing said flux composition from a gas-phase. Claim 1 is hereby amended to clarify an aspect of the present invention, specifically that the present invention provides a means of applying a complexing agent from a gas-phase. Provision of a complexing agent from a gas-phase

was taught in the original disclosure at, for example, page 4, lines 15-17. Therefore, the amendment does not comprise new matter. Claim 9 depends from claim 1.

A *prima facie* case of obviousness has not been made out because the art cited by the Examiner fails to teach each aspect of the present invention. Specifically, claim 1 as amended recites "providing a gas-phase ambient comprising a complexing agent; [and] applying said complexing agent from said gas-phase to said solderable surface." Arldt does not teach application from a gas-phase, as required to meet the present invention. Rather Arldt teaches a liquid flux composition that is applied by brushing or spraying (see col. 5, lines 13-14; col. 6, lines 3-4). Arldt is silent as to gas-phase application. Marshall, Jr. is cited for the desirability of storing the protected surface for later reflow. Marshall, Jr.'s teaching does not relate to gas-phase application, as required by the present invention, and therefore, does not address the shortcomings of Arldt.

Conclusion:

In view of the above, consideration and allowance are, therefore, respectfully solicited.

In the event the Examiner believes an interview might serve to advance the prosecution of this application in any way, the undersigned attorney is available at the telephone number noted below.

The Commissioner is hereby authorized to charge any fees or credit any overpayment associated with this communication, including any extension fees or fees for the net addition of claims, to Deposit Account No. 22-0185.

Respectfully submitted,



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APPENDIX

(Amended Claim)

Please amend claim 1 as follows:

1. (Twice amended) 1. (Twice amended) A method of protecting tin solderable surfaces comprising:

providing a solderable surface having tin oxide thereon;

providing a gas-phase ambient comprising a complexing agent;

applying said complexing agent from said gas-phase to said solderable surface;

forming a protected solderable surface by forming a reaction product with said tin oxide and said complexing agent, wherein said reaction product decomposes to a decomposition product selected from the group consisting of tin oxide and volatile products upon being exposed to [reflux] reflow conditions; and

storing said protected surface for later reflow.